



National Aeronautics
and Space Administration

JULY 31, 2002
NRA 02-OSS-03

RESEARCH ANNOUNCEMENT

**FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER
(FUSE)**

GUEST INVESTIGATOR PROGRAM

CYCLE 4

Notice of Intent Due:
Proposals Due:

**AUGUST 30, 2002
OCTOBER 10, 2002**

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER
(FUSE)

GUEST INVESTIGATOR PROGRAM

Cycle 4

NASA Research Announcement
Soliciting Proposals for Basic Research

NRA 02-OSS-03

Release Date: July 31, 2002

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Proposal Due Date: October 10, 2002

Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER (FUSE)

GUEST INVESTIGATOR PROGRAM - Cycle 4

SUMMARY OF SOLICITATION

This NASA Research Announcement (NRA) solicits basic research proposals for participation in the National Aeronautics and Space Administration (NASA) program for space science observations and subsequent analysis of the resultant data from the Far Ultraviolet Spectroscopic Explorer (FUSE). The FUSE mission is designed to investigate the nature and physics of interstellar and intergalactic gas, stars, galaxies, and planets through the use of high-resolution spectroscopy of far ultraviolet (905-1187 Å) radiation.

Note that this NRA does not solicit proposals for research using FUSE data that are already archived in public data bases. Such proposals should be submitted through the Astrophysics Data Program described in NRA 02-OSS-01, entitled "Research Opportunities in Space Science" (access at http://research.hq.nasa.gov/code_s/nra/current/NRA-02-OSS-01/index.html).

FUSE is a Principal Investigator (PI)-class NASA mission. The FUSE PI, Dr. Warren Moos of Johns Hopkins University (JHU), is responsible to NASA for mission design, development, and operations. The FUSE mission was developed in cooperation with Canada and France, whose resident scientific personnel share in the observing time as indicated in Appendix C, Section C.1.3.

Beginning with Cycle 4, the first year of the Extended Mission phase, all FUSE observing time is available to the general astronomical community via this FUSE Guest Investigator (GI) Program. This NRA is the fourth announcement for the FUSE GI Program and solicits proposals only for Cycle 4, which is planned for the 12-month period beginning in April 2003. NASA anticipates that at least 4500 kiloseconds of on-target exposure time will be allocated to GI Programs selected through this NRA.

Following the failure of two of the FUSE reaction wheels in late 2001, the FUSE attitude control system was significantly modified to permit the continuation of the mission. The new hybrid pointing system uses the two remaining reaction wheels, plus the 3-axis magnetic torquer bars to control the satellite's slewing and pointing. Regular science operations resumed in March 2002 with no loss in instrument performance. Initially, observations were restricted in sky coverage (see Appendix A) due to limited experience with this new type of magnetic control system. Due to ongoing characterization of the new control system and tests to increase sky coverage, mission capabilities may be updated after the release of this NRA. Therefore, any change to the mission capabilities described in Appendix A will be posted as an amendment to this NRA no later than 30 days prior to the proposal submission deadline. It is the responsibility of all interested proposers to monitor this NRA site to ensure that their proposal is compliant with such new information.

Participation in this FUSE GI Program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit organizations, NASA Centers, and other Government agencies. Proposals may be submitted at any time before the

proposal due date. Scientists planning to propose should submit a Notice of Intent (NOI) to propose in order to facilitate the timely selection of proposal review panels. Proposals received in response to this NRA will be evaluated in a competitive scientific peer review conducted by NASA Headquarters, with a goal of announcing the selection approximately four months after the proposal due date. Proposals will be reviewed by panels organized by research area and/or topic. A schedule specifying Cycle 4 proposal deadlines is provided at the end of this Summary of Solicitation.

Limited funds for awards under this NRA are expected to be available to investigators at U.S. institutions subject to the annual NASA budget cycle. The Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals that the Government determines are acceptable for award under this NRA. At the time of release of this NRA, \$2.4M are anticipated to support up to 60 U.S. investigations in Cycle 4, subject to change based on a major review of Astrophysics operating satellites that is expected to conclude in July 2002. Any changes to these estimates will be posted as an amendment to this NRA at the earliest possible time. In most cases, investigations selected for award under this NRA will be funded through the use of grants, but contracts will be used as may be appropriate for for-profit institutions. Budgets should not be submitted with observing proposals. Only after a proposal has been awarded observing time, based on scientific peer review, will a budget and institutional signature be required (see Appendix C for detailed instructions).

Proposers whose investigations are awarded observing time will have sole use of their data for six months after the processed data are placed in the FUSE data archive. After this time, the data will be available from an archive that is open to the public.

Education and the enhancement of public understanding of space science are vital and integral parts of all NASA space science missions and research programs. Therefore, NASA OSS encourages any successful U.S. proposer awarded observing time under this NRA to submit a supplemental Education/Public Outreach (E/PO) component with their research program. NASA expects to allocate approximately 1-2% of the FUSE GI data analysis budget for E/PO activities. Note that originality is not a criterion of such E/PO tasks; rather the important factor is that a tenable task of merit be proposed. Also, E/PO proposals are to be submitted **only** in conjunction with the budget phase of the proposal process. Following the selection of scientific proposals, successful U.S. proposers will receive complete information for preparing and submitting E/PO proposals.

Important information about the FUSE GI Program and proposal preparation and submission are included in the Appendices as follows: Appendix A gives an overview of the mission and describes the observing opportunity. Appendix B gives the general instructions for responding to NASA Research Announcements. Appendix C, which supersedes and augments Appendix B, provides NRA-specific information on proposal preparation, submission, evaluation, and selection. Finally, lists of the astronomical targets planned for observation prior to the start of Cycle 4 may be obtained from the FUSE GI Program Web site at URL <http://fusegi.pha.jhu.edu/>.

Technical and reference documents are available interactively from the FUSE Science Center at JHU over the World Wide Web, for download via the Web at <http://fusegi.pha.jhu.edu/> or anonymous ftp, and in hard copy by request at the documentation address given below. Of particular value is *The FUSE Observer's Guide*, which contains an overview of the mission capabilities, a detailed instrument description, and information about proposing for FUSE

observing time (e.g., instructions for assessing feasibility, instrument summary, constraint summaries, and the calculation of exposure times).

The following Summary Information applies to this NRA.

• <i>Program Alpha Numeric Identifier</i>	NRA 02-OSS-03
• <i>Date of NRA Release</i>	July 31, 2002
• <i>Access to NRA text</i>	Link through menu listings <i>Research Solicitations - >Current (Open) Solicitations</i> starting from the OSS home page at http://spacescience.nasa.gov/ .
• <i>Guidance for preparation and submission proposals</i>	See Appendix C of this NRA.
• <i>Notice of Intent (NOI) to propose</i> (encouraged but not required): - Desired Due Date - Web site for electronic submission - Late submission (up to 15 days prior to Proposal Deadline)	Release date + 30 days, 2002 Log into Web site http://proposals.hq.nasa.gov select "OSS – Astronomy and Physics Division" in the menu entitled <u>Division Specific Opportunities</u> , then select this NRA by name. Submit information by E-mail to proposals@hq.nasa.gov .
• <i>Proposal Submission Requirements</i> (See also Appendix C for details)	Submit <i>Proposal Cover Page</i> electronically and print out hard copy at same Web address as for NOI above plus Send 12 printed copies, including printed <i>Proposal Cover Page</i> to: FUSE Guest Investigator Program <u>Office of Space Science</u> NASA Peer Review Services Suite 200 500 E Street., SW Washington, DC 20024-2760 USA Telephone: 202-479-9030 plus Electronically submit the required FUSE proposal forms to fuseprop@pha.jhu.edu

• <i>Proposal Due Date</i>	October 10, 2002
• <i>Education/Public Outreach Proposals</i>	May be submitted only by selected proposers at the time Budget is due; see Appendix C.
• <i>Selecting Official</i>	Director Astronomy and Physics Division Office of Space Science
• <i>Point of contact for additional information about this NRA</i>	Dr. Hashima Hasan FUSE Program Scientist Astronomy and Physics Division Code SZ Office of Space Science National Aeronautics and Space Administration Washington, DC 20546-0001 USA Tel: 202-358-0692 Fax: 202-358-3096 E-mail: hashima.hasan@hq.nasa.gov
• <i>Point of contact for scientific and technical questions about this NRA and program documentation</i>	Dr. George Sonneborn FUSE Project Scientist Laboratory for Astronomy and Solar Physics Code 681 National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt, MD 20771 USA Tel: 301-286-3665 Fax: 301-286-1753 E-mail: george.sonneborn@gsfc.nasa.gov
• <i>Point of contact for technical information about the FUSE mission</i>	Dr. B-G Andersson FUSE Guest Investigator Officer Department of Physics and Astronomy Johns Hopkins University Baltimore, MD 21218 USA Tel: 410-516-8378 Fax: 410-516-5494 E-mail: fuse_support@pha.jhu.edu
• <i>FUSE GI program Web site</i>	http://fusegi.pha.jhu.edu
• <i>FUSE technical information Web site</i>	http://fuse.pha.jhu.edu/
• <i>FUSE Observer's Guide Web site</i>	http://fuse.pha.jhu.edu/support/guide/obsguide.html

NASA appreciates your interest and cooperation in participating in Cycle 4 of the Far Ultraviolet Spectroscopic Explorer Guest Investigator Program.

Anne L. Kinney
Director
Astronomy and Physics Division

APPENDICES

- A. FUSE Guest Investigator Program and Mission Description – Cycle 4
- B. Instructions for Responding to NASA Research Announcements for Solicited Basic Research Proposals
- C. Proposal Preparation, Submission, Evaluation, Selection, and Implementation
- D. Certifications

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER (FUSE) GUEST INVESTIGATOR PROGRAM AND MISSION DESCRIPTION – Cycle 4

A.1 Guest Investigator (GI) Program Description

A.1.1 Overview

The Far Ultraviolet Spectroscopic Explorer (FUSE) provides high-resolution ($R \sim 20,000$) spectroscopy at far ultraviolet (FUV) wavelengths (905-1187 Å) with sufficient sensitivity to study a wide variety of objects, including many extragalactic lines of sight. FUSE was launched on June 24, 1999. The FUSE Prime Mission is scheduled for completion in March 2003. An *Extended Mission* phase starts in April 2003 and expands the period over which the scientific capabilities of FUSE are available to the astronomical community. A brief description of the FUSE mission is provided in Section A.2

Under this NRA, NASA seeks proposals for FUSE Guest Investigator (GI) observing programs for Cycle 4, the first year of the Extended Mission phase. GI observing programs should exploit the unique capabilities of FUSE. The content and scope of GI programs must be consistent with Extended Mission capabilities and the observing program policies and guidelines discussed below.

There are two important changes to the FUSE GI program starting in Cycle 4. (1) All observing time, except for calibration and Discretionary Observing Time (Section A.1.6), will be selected through this NRA; there are no reserved targets or guaranteed observing time programs. (2) GI programs will be accepted in one of two categories: Standard programs, for which NASA intends to execute all observations associated with the allocated observing time, and Survey and Supplementary programs, which provide a pool of targets to maximize the science return and observing efficiency. Standard programs will receive scheduling priority. Not all targets for Survey programs will be observed. Further details are given in Section A.1.2.

Proposals submitted in response to this NRA constitute the first phase of the FUSE GI proposal process. Information required during this proposal phase includes the scientific justification, observation descriptions, astronomical target data, exposure times, and any special operational requirements (e.g., orientation constraints, timing considerations, etc.). After selection by NASA, successful GI's must submit detailed observing plans to the FUSE Science Center at the John Hopkins University (JHU) so that detailed planning, feasibility assessment, and observation scheduling can be performed. Section A.1.3 describes some important capabilities and constraints that affect how GI programs will be evaluated and implemented in Cycle 4.

There are two types of unscheduled observing time that can be made available with the approval of the FUSE Project Scientist. The first deals with major Targets of Opportunity (ToO), such as supernovae, novae, and comets (see Section A.1.5). The second type, called Project Scientist's Discretionary Observing Time, is intended for observations of an urgent nature requiring a small amount of observing time and of sufficiently high scientific priority that they should not be delayed to the next observing cycle (see Section A.1.6).

A.1.2 Observing Program Categories and Time Allocation

FUSE observing time is allocated in on-target exposure time in units of kiloseconds (ksec). Proposals should request only the time needed for scientific exposures. In previous cycles the average GI observing program size was ~50 ksec. About 25% and 50% of the Cycle 3 GI time was allocated to programs with more than 150 and 80 ksec, respectively.

Observing Program Categories – Each FUSE observing proposal must be designated in one of two proposal categories at the time of submission, *Standard* or *Survey*, and this category must apply to all proposed targets in the proposal.

1. *Standard* proposals correspond to the type of observing programs carried out during the FUSE prime mission (Cycles 1-3). These are regular observing proposals and may contain constrained or unconstrained observations (see Section A.1.3).
2. *Survey* is short for *Survey and Supplementary* and indicates a category of proposal that will provide a new type of observing program and scheduling flexibility. Survey programs provide the opportunity for observations of a class of objects to be undertaken without the requirement that a specific object be observed. No constrained observations are allowed in Survey proposals and all targets must be at $|\delta| \geq 40^\circ$. The Survey category is new beginning in Cycle 4.

NASA intends to allocate about 70% of the total available time in Cycle 4 to Standard observing programs, and the expectation is that all targets in this category will be observed. The time allocated to Survey and Supplementary programs will intentionally oversubscribe the available time. There is no guarantee that any specific target in Survey programs will be observed, although NASA expects that many targets in this category will be included in the FUSE observing plan. Following the evaluation of submitted proposals, some proposals submitted but not accepted by NASA under the Standard category may be recommended for inclusion in the Survey category, but only for unconstrained observations. It will be the proposer's option to accept or reject such reprogramming of a submitted Standard proposal.

Observing Program Size – Large observing programs are an essential part of the FUSE science program, and they can provide the observing resources to address significant and/or difficult observing programs. NASA expects to allocate about 25% of the available time in Cycle 4 to programs needing more than 150 ksec. Such proposals should be written according to the guidelines and instructions given in Appendix C and will be reviewed with other proposals in the same research category.

Due to the difficulties associated with administering many very small programs, each proposal must request a minimum of 10 ksec of on-target exposure time. If the proposal has only one target, the exposure time on that object must be at least 10 ksec. A proposal having multiple targets can have exposure times of less than 10 ksec per target provided the total exposure time for the proposal is at least 10 ksec. There is no other limitation on program size for Standard or Survey programs.

Short Exposures – If a target has an exposure time less than 4 ksec, the program will be charged 4 ksec for that observation to account for the extra overhead associated with short-duration observations. The FUSE mission planning system was designed to support a pool of observations that requires an average of no more than three pointing maneuvers per day. Short exposures should not be arbitrarily extended to 4 ksec if the required signal-to-noise ratio (S/N) is expected to be reached in a shorter time.

Observing Program Duration – Proposers may only request observations to be executed during the nominal 12-month period of Cycle 4 (i.e., multicycle proposals will not be accepted). If proposers want to continue their scientific programs over multiple cycles, they must repropose their investigations in subsequent GI cycles.

Program Execution and Carryover – NASA intends that all non-ToO Standard observing programs will be executed. If necessary, observations for Standard programs will be carried over into the following cycle if they are not executed during the current cycle. GI's do not need to repropose for these observations, and any such programs will be given priority for execution in the next cycle. However, ToO programs will **not** be carried over into the next Cycle. Survey and ToO programs that are not activated and executed within the nominal one-year observing cycle must repropose in order to be considered in the next observing year.

A.1.3 Mission Capabilities and Constraints During Cycle 4

This section highlights several recent developments that should be considered by all FUSE proposers. Most aspects of the FUSE instrument are unchanged from previous observing cycles, including channel coalignment, spectrograph apertures, spectral resolution, and sensitivity. Complete information on these and other topics is available from the FUSE Observer's Guide at <http://fuse.pha.jhu.edu/support/guide/obsguide.html>.

Sky Coverage – Following two reaction wheel failures in late 2001, the FUSE attitude control system was significantly modified to permit the continuation of the mission. The new hybrid pointing system uses the two remaining reaction wheels plus the three-axis magnetic torquer bars (MTB) to control the satellite's slewing and pointing. Regular science operations resumed in March 2002, but observations were restricted to targets at $|\delta| \geq 40^\circ$. The ability to observe targets closer to the celestial equator is presently under active test and development. Consequently, the mission's capabilities in this area are dynamic. Several observations at $\delta = 8^\circ$ and 23° have been successfully obtained (May 2002) and more are planned. NASA is optimistic that full sky coverage will be available in Cycle 4. However, the actual amount of observing time and the

number of observations that can be obtained at $|\delta| < 40^\circ$ are currently uncertain. In general, longer observations at low declinations will be more difficult to accomplish than shorter observations. Proposers are strongly encouraged to consult the FUSE GI program Web site to obtain the most up to date information on the mission's capabilities for the preparation of Cycle 4 proposals.

Constrained Observations – A *constrained observation* is one with a total visibility of three weeks or less during the year. This includes observations coordinated with other space observatories, targets of opportunity, observations with tight roll angle constraints, monitoring and ephemeris special requirements. Targets at low declinations ($|\delta| < 40^\circ$) and observations that significantly impact the overall observing schedule, such as target monitoring campaigns, may also be classified as constrained observations. Further information and tools for assessing potentially constrained observations can be found on the FUSE Web site.

Proposers must identify any such constrained observations in their proposals. The peer review panels will assess the criticality and potential benefits of these observations when evaluating the scientific merit of the proposal (see Appendix C.6). NASA anticipates that only a limited number of constrained observations can be supported per year during the Extended Mission, and the actual number depends on approved funding levels, as mentioned in this NRA's Summary of Solicitation.

Scheduling decisions for Cycle 4 observations can be made only after Phase 2 data for all accepted programs have been submitted and reviewed. Any requests for constrained observations not identified in the original proposal, will be critically reviewed by NASA. Approval of such late requests for constrained observations depend on the availability of observatory resources and will be made on a case by case basis prior to any scheduling activity by the FUSE Project.

Instrument Performance – Recent tests have demonstrated that higher S/N ratio spectra can be obtained with special observing techniques. Cycle 4 proposers may propose S/N up to 100 per 0.05Å resolution element. See the FUSE Observers Guide for details and restrictions.

Exposure Times and Channel Selection – Because the FUSE spectral resolution varies with wavelength and from channel to channel at a given wavelength, it may not always be possible to combine data from different channels and maintain the desired spectral resolution. Proposers should consider whether to define their exposure times based on achieving a desired S/N ratio in a single channel if the spectral resolution requirements exceed $R \sim 10,000$. This, in effect, reduces the effective area of the instrument but ensures that there are adequate counts to meet the resolution and S/N requirements.

Channel selection may also significantly affect schedulability and whether an observation is considered constrained or not. For example, an observation requiring the LiF channels only ($\lambda > 1000 \text{ Å}$) is easier to schedule than one that requires both LiF and SiC channels. The Beta angle limit may be increased above the standard limit of 90° for an observation that requires LiF1 only.

Exposure Times And Observations Obtained During Orbital Night – Observations of fainter objects in the LWRS aperture may be adversely affected by terrestrial air glow emission. These effects can be significantly reduced by analyzing only the night-time portion of the obtained data set. Because FUSE cannot easily be retargeted within orbits, the scheduling of night-only observing is extremely inefficient. Therefore, there is no "night-only" mode of observing with FUSE. If an observation requires a significant amount of night-time data, the requested exposure time must be increased by a factor of 1.6 to obtain the desired exposure during the night-time portion of the orbit. See the FUSE Observer's Guide for details.

Sensitivity Limits – There are fundamental detector performance limitations for both faint ($F_\lambda \leq 5 \times 10^{-15} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$) and bright ($F_\lambda > 3 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$) targets. Proposers expecting to observe objects near either extreme should consult the FUSE Observer's Guide for further information and restrictions. Potential proposers are alerted to new developments that under certain circumstances permit sensitivity limits to be pushed toward fainter and bright flux levels.

Observations of objects as faint as $\sim 1 \times 10^{-15} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$, depending somewhat on wavelength, have been successfully observed. This is about a factor of ~ 2 -3 fainter than was previously possible. Exposure times must be long enough so that the background can be determined within the data set itself. Special data processing techniques are also necessary.

New observing techniques are being tested that may permit limited observations of objects at least a factor of 5 brighter than the bright limit in effect in previous observing cycles. This would effectively raise the bright limit, with certain limitations, to 5 - $6 \times 10^{-10} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$, and possibly higher, but may be applicable to only part of the FUSE spectral range. As bright object observing techniques continue to be tested, updated information about their performance and availability during Cycle 4 will be posted on the FUSE web site.

A.1.4 Data Rights and Distribution

Data rights for FUSE GI observations (Standard and Survey programs) will reside solely with each observing program's Principal Investigator for a period of six months following delivery of the processed data to the FUSE data archive (<http://archive.stsci.edu/fuse>). GI's will be notified electronically when their data are available from the archive. After this period, the data become available for public access through the FUSE data archive (see Section A.2.4).

Observations of calibration targets generally have no proprietary period and will be released through the FUSE archive as soon as the processed data products are available. The FUSE Project reserves the right to use any FUSE observation to assist in assessing the performance of the instrument, but the confidentiality of data obtained for scientific programs will be maintained.

A.1.5 Proposals for Targets of Opportunity

Proposals for major Targets of Opportunity (ToO), such as supernovae, novae, cataclysmic variables in outburst, comets, etc., will be supported in Cycle 4. Scientists wishing to observe

such targets should prepare and submit proposals according to the same procedures used for the regular program (i.e., as described in the following sections of this Appendix). Note that a proposal must not contain a mixture of ToO targets and non-ToO targets. Target of Opportunity status should be noted in the Special Requirements section of the proposal. The proposals will be reviewed in the regular review cycle, and successful proposals will be approved but will not be allocated specific amounts of observing time. (However, the review panels may recommend a maximum amount of observing time that should be allocated to a given ToO program.) Up to four ToO programs requiring a response time of one month or less will be approved for Cycle 4.

The lack of a real-time observing capability constrains the speed with which a ToO observation can be implemented. The FUSE ToO response time for prompt events is expected to be 2-7 days during Cycle 4. ToO proposals must clearly state the required response time. It will be the GI's responsibility to notify the FUSE Project Scientist and the FUSE Science Center at JHU when any approved opportunity has occurred. The Project Scientist will consult with the GI, the FUSE PI, and other members of the FUSE Project to determine the feasibility of observing the particular event and the impact of disrupting ongoing observations before deciding whether or not to activate the ToO program and approve the observation.

A.1.6 Discretionary Observing Time

Project Scientist's Discretionary Observing Time (DOT) is intended for observations of an urgent nature for which no approved observing program exists, which can be accomplished with a small amount of observing time, and which are of sufficiently high scientific merit and priority that they should not be delayed to the next observing cycle. The total amount of DOT available during Cycle 4 is extremely limited. The FUSE Project Scientist may approve DOT in those cases where the scientific timeliness of the project is such that it should be done quickly, the need for the observation could not have been foreseen and proposed for in the current observing cycle, and the observation does not duplicate or infringe on approved GI programs. A proposal for DOT may be submitted to the Project Scientist in the form of a letter (printed or electronic) and should describe the observations and their feasibility and scientific objectives, and explain why DOT should be granted in lieu of consideration during the next proposal cycle. All requests for DOT will be reviewed for scientific merit and technical feasibility.

A.1.7 Targets For Observation

This NRA primarily seeks to identify new targets for observation with the FUSE satellite. Lists of previously observed targets and those planned for observation in Cycle 3 are available from the FUSE GI Program Web site. Proposers should bear in mind that the FUSE instrument has essentially only one observational mode. Aside from small differences resulting from the choice of aperture, the exposure time alone defines the achievable signal-to-noise ratio for a given spectral resolution for observations of point sources. The target's name and celestial coordinates (right ascension and declination in epoch J2000) will be considered when judging any potential target duplications.

Target Duplication – Any duplication of targets between Cycle 4 GI programs and those observed in previous Cycles must be strongly justified in the proposal. The review panels will receive a summary of any duplication between pending and existing observations and those proposed for Cycle 4. The panels will also receive a summary of target duplications between different Cycle 4 proposals. In general, a given target will be allocated to only one observing program. Failure to provide accurate target data in the proposal may result in disallowing a target if a conflict with another program is discovered after proposal acceptance and the target conflict was missed as a result of the inaccurate target data. Lists of previous and pending FUSE observations are provided on the FUSE GI Web site.

Target List Modifications – After selection of Cycle 4 programs, changes to a program's target list may be made with the approval of the FUSE Project Scientist. Any new target must be consistent with the program's scientific objectives and must not already be allocated to another program.

Calibration Targets – Astronomical targets are used for photometric, flat-field, and wavelength calibration. Most, but probably not all, of the calibration objects listed (see the GI Program Web site) will be observed for calibration purposes. GI's are allowed to include calibration targets as scientific targets in their programs. The FUSE Project may continue to use these objects for calibration, even if the target is allocated to a GI program.

A.2 The FUSE Mission

A.2.1 Mission Overview

FUSE is a PI-class mission, developed in collaboration with the space agencies of Canada and France. The FUSE Principal Investigator, Dr. Warren Moos of the Johns Hopkins University (JHU) in Baltimore, Maryland, is responsible to NASA for the mission design, development, and operations. FUSE is controlled from the FUSE Satellite Control Center located on the JHU campus in Baltimore, Maryland. The FUSE PI is responsible for achieving the several important scientific objectives of the mission. These are the study of (1) the abundance of deuterium in a variety of astrophysical environments, from the local interstellar medium to distant gas clouds along the lines of sight toward quasars and active galactic nuclei, and (2) the amount, distribution, and kinematics of hot gas (as traced by the O VI ion) in the Milky Way disk and halo and in the Magellanic Clouds in order to understand the origin and dynamics of hot gas in these galaxies. About half of the observing time during the FUSE prime mission was allocated to the PI Team, and the initial scientific results have been disseminated in the refereed literature.

The spectral window covered by FUSE permits the study of many astrophysically important atoms, ions, and molecules that cannot otherwise be investigated. This wavelength range is extremely rich in spectral lines arising within the interstellar gas. Proposers are encouraged to take full advantage of the capabilities of FUSE to address important problems in astrophysics. The FUV spectral range provides an opportunity for unique studies of many types of astrophysical objects, such as AGN's and quasars, massive stars, supernova remnants, nebulae,

the outer atmospheres of cool stars, planets and their satellites, and comets, as well as interstellar and intergalactic material.

A.2.2 Instrument Overview

FUSE obtains spectra in the 905-1187 Å far-UV band with high resolving power ($R \sim 20,000$) and high throughput. FUSE has four optical channels, each of which is fed by separate off-axis parabolic mirrors that serve as the primary mirrors for four co-aligned telescopes, all of which simultaneously view the same astronomical field at the same magnification. A Focal Plane Assembly (FPA) is at the focus of each mirror and consists of a flat mirror mounted on a precision two-axis micromotion stage. There are three entrance apertures built into each FPA. The combined effective area of all four channels ranges from $\sim 20 \text{ cm}^2$ to $\sim 70 \text{ cm}^2$, depending on the wavelength.

The high throughput results from the use of an efficient multichannel optical design and reflective coatings optimized for wavelength coverage in the FUSE range. The spectrograph gratings disperse and refocus the light onto two 2-dimensional delay-line microchannel plate detectors. The entire wavelength range is simultaneously covered on each detector by combining data from two optical channels. Two of the optical channels (one LiF and one SiC) feed one detector, the other LiF and SiC channels feed the other detector. The channels with SiC-coated optics cover $\sim 905\text{-}1100 \text{ Å}$, and the channels having LiF-coated optics cover $\sim 990\text{-}1185 \text{ Å}$. The resulting spectral images are highly astigmatic in the cross-dispersion direction. Spatially resolved spectral data of limited quality are available only at a few specific wavelengths where this astigmatism is minimized.

Further details on the FUSE instrument can be found the FUSE Observer's Guide, available online at <http://fuse.pha.jhu.edu/support/guide/obsguide.html>.

A.2.3 Satellite Operations and Observation Planning

FUSE is in a nearly circular orbit with a mean altitude of 768 km, an orbital inclination of 25° , and an orbital period of ~ 100 minutes. The plane of the orbit precesses with a period of ~ 60 days. Typically, FUSE is in contact with the ground station for 10-12 minutes per orbit for seven consecutive orbits, followed by eight orbits (~ 12 hours) with no contact. All FUSE scientific observations are conducted autonomously by the onboard instrument data system.

One of the main observational constraints is the restrictions in *beta* angle, defined as the angle between the anti-Sun direction and the telescope boresight, which is restricted to values between 15° and 105° . However, observations are normally scheduled in the range $30^\circ < \textit{beta} < 90^\circ$ in order to maintain coalignment of the four spectroscopic channels. Since the channel alignment is sensitive to changes in the instrument's thermal environment, the *beta* angle is an important scheduling parameter. Observations outside the normal *beta* angle range are possible but must be carefully planned in advance. See Section A.1.3 and the FUSE Observer's Guide for further information.

A.2.4 Data Processing, Calibration, and Distribution

The FUSE data processing pipeline corrects the two-dimensional raw data for instrumental effects and produces one-dimensional, calibrated, extracted spectra. Each exposure produces independent SiC and LiF spectra on each of four detector segments (two segments for each FUSE detector) for a total of eight independent spectra. The data processing system is described in the FUSE Data Handbook (<http://fuse.pha.jhu.edu/analysis/dhbook.html>).

The wavelength calibration maps pixel coordinates into the wavelength domain. The relative wavelength accuracy is $\sim 10 \text{ km s}^{-1}$, depending on the channel. There is a zero-point shift in the wavelength scale, which depends on the relative locations in the aperture of the science target and the calibration object used to calculate the dispersion solution. For observations made in the LWRS aperture this offset can be as large as 50 km s^{-1} . The FUSE photometric calibration has an absolute accuracy of $\sim 10\%$ and a rms relative uncertainty of no more than 5%. However, the accuracy realized during an observation depends critically on the stability of the target within the aperture of a particular channel.

The FUSE data are archived at the Multimission Archive at Space Telescope (MAST) at URL <http://archive.stsci.edu/fuse/>. Access procedures for proprietary and public data are similar to those for Hubble Space Telescope data. Only the PI of each GI program (and their designees) can access that program's data during the proprietary period. The distribution of FUSE data is made by electronic file transfer from the FUSE archive. Observations of calibration targets generally have no proprietary period. See Section A.1.4 for additional information about FUSE data rights.

A.2.5 FUSE Observers Advisory Committee

The FUSE Observer's Advisory Committee (FOAC) was formed by the FUSE Project Scientist in the 1999. Membership of the FOAC is drawn primarily from the names of Principal Investigators of GI programs. The FOAC meets periodically to advise the Project Scientist on matters concerning the FUSE GI program. See the FUSE GI Program Web site (<http://fusegi.pha.jhu.edu/>) for the current FOAC membership and minutes of the FOAC meetings.

APPENDIX B

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(May 2002)

NASA Federal Acquisition Regulations (FAR) Supplement (NFS)

Part 1852.235-72

(accessible through URL: <http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRA's contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRA's.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRA's are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRA's; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRA's will generally specify topics for which additional information or greater detail is desirable. Each

proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) Abstract. Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) Management Approach. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) Personnel. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs (U.S. Proposals Only).

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and

wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) Security. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) Current Support. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals.

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) Late Proposals. Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) Evaluation Factors.
(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award

during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) Selection for Award.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations may arrange with the foreign sponsor for the proposed participation on a no-exchange-

of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

(End of provision)

APPENDIX C

PROPOSAL PREPARATION, SUBMISSION, EVALUATION, SELECTION, AND IMPLEMENTATION

The information contained in this Appendix C augments and supersedes Appendix B and applies only to this NRA.

C.1 General Guidelines and Policies

C.1.1 Proposal Process

Proposers should submit a Notice of Intent to Propose (see the NRA Summary of solicitation and Section C.4) in order to facilitate the timely selection of peer review panels. Note that Notices of Intent are not required to propose for the FUSE GI program. Proposals may be submitted at any time before the proposal due date.

Proposals submitted in response to this NRA should provide the scientific justification and feasibility analysis, which form the basis for selection by NASA. Proposers who are awarded observing time, based on the evaluation process described in Section C.6, will subsequently be required to submit observation specifications following guidelines provided by the FUSE Project. These data will provide the FUSE Science Center with the detailed definition of each observation to be executed for the program. In addition, U.S. proposers will be invited to submit a budget based on funding guidelines provided by NASA – see Section C.8.

Submission of proposals in response to this NRA has three components:

1. proposal summary information must be submitted through the designated NASA Web page and used to print the proposal's *Cover Page/Proposal Summary* (see Section C.2.2);
2. the specified number of printed copies of the complete proposal, including a printed copy of the *Cover Page* signed by the PI, must be submitted to the address given in the NRA Summary of Solicitation (see Section C.5); and
3. a FUSE Cycle 4 proposal template, also referred to as the Proposal Form, must be completed and submitted electronically (see Section C.2.3).

C.1.2 Who May Propose

Participation in the FUSE GI Program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, and other Government agencies. Each FUSE GI proposal must identify a single Principal Investigator (PI) who assumes full responsibility for the conduct of the scientific investigation. Proposal Co-Investigators must have well-defined roles in the investigation, which will be evaluated as part of the proposal review process. Following selection by NASA, the FUSE Science Center at the Johns Hopkins University (JHU) will communicate formally only with the PI (or his/her designee) of each proposal. It is this person's responsibility to provide JHU with

the necessary data that defines each observation in a timely manner and to respond to any questions concerning observational constraints or configurations.

C.1.3 Canadian and French Observing Time

As part of their participation in and contribution to the FUSE mission, Canada and France each receive a minimum of 5% of the mission's observing time as defined in Letters of Agreement between NASA and their respective space agencies. This observing time will be selected competitively via the GI proposal peer review process described in this NRA. Scientists at Canadian and French institutions should follow the instructions in this Appendix for proposal preparation and submission. Note, however, that an institutional endorsement of the type described in the Section C.1.4 is not required for Canadian and French proposals submitted in response to this NRA.

C.1.4 Guidelines for other than Canadian and French Non-U.S. Participation

See Part (I) of Appendix B.

C.1.5 Late Proposals

NASA's general policy on late proposals is given in Part (g) of Appendix B and states that such a proposal may be considered only if it is judged to be in the best interests of the Government. Owing to the historically large over-subscription of proposals for this program, a proposal submitted after the published deadline is unlikely to be considered of uniquely greater value to NASA than the proposals that are submitted on time. A proposal is considered to have been submitted on time only if all necessary components, including electronic material, have been received by the published deadline. Finally, note that processing delays at the proposer's home institution, the method of shipment of the proposal, or Internet delays do not excuse the late submission of a proposal.

C.2 Proposal Preparation

C.2.1 Proposal Format and Content

Proposals must be concisely written in English. The length of each section of the proposal should not exceed the page limits indicated below, using single-spaced 8.5x11 inch or A4 format paper with 1 inch (2.5 cm) margins. Proposals must be printed with a font size no smaller than 11 points (about 6 characters per cm). Reviewers will be instructed to base their review on only the portion of each proposal that complies with the page limits given below in this NRA. Double-sided copies are encouraged. Illustrations contained in the printed proposal may be in black and white or color.

C.2.2 *Cover Page/Proposal Summary*

All proposals must be prefaced by an integrated *Cover Page/Proposal Summary* that contains important, required information. This item is produced by first entering the requested information electronically through a NASA Peer Review Services (NPRS) Web site specified in this NRA's Summary of Solicitation and then printing this form by the proposer. Note that a sample of this Web form may be printed at any time for preliminary inspection. The printed copy of the electronically submitted form must be signed by the PI and submitted as part of the original proposal and all copies.

The *Cover Page/Proposal Summary* includes the following information: Proposal title (both abbreviated and full length); PI name, institution, address, and telephone number; Co-I name(s) and institution(s); proposal summary (restricted to about one-half page of text); proposal category (see Section A.1.2); scientific category (see further below); and total requested observing time. This *Cover Page/Proposal Summary* must be signed by the PI and used as the preface of all submitted copies of the printed proposal (see Section C.5). An institutional signature is **not** required until a budget is submitted by proposers who are awarded observing time.

The authorizing institutional signature also serves to verify that the proposing institution has read and is in compliance with all Federally required Certifications (Note: for reference only, all currently required Certifications are printed in full in Appendix D).

The last three digits of the identification number assigned to your proposal by the NASA Peer Review Services Web site must also be included in the required LaTeX proposal form. This identifier is displayed on the Web page and printed at the upper left-hand corner of the *Cover Page/Proposal Summary*. For example, in the proposal identifier "NRA-00-05-OSS-189," the ID number is the last three digits "189."

C.2.3 LaTeX Proposal Template

The FUSE proposal form uses an ASCII LaTeX file that allows the proposer to supply certain information for a set of keywords, including the proposed target list. Some keywords are required (e.g., proposal title, PI name and address, abstract, total observing time requested, etc.) and some are optional (e.g., special requirements). For proposers familiar with LaTeX, the proposal form may also be used to format the final printed proposal. Electronic submission of the LaTeX proposal form (without figures) is required of all proposers, since this file will be part of the database used to support the proposal review. Instructions for obtaining the proposal form are given in Section C.3, and submission procedures are described in Section C.5.

The FUSE LaTeX proposal form defines a number of sections, or subject areas, including the proposed target list and exposure times. These proposal sections are listed below and should be contained in the proposal in the order indicated.

Summary Information – Proposal summary information, the same as that submitted to the NASA Peer Review Services Web site for the *Cover Page/Proposal Summary*, must also be supplied in the LaTeX proposal form. In addition, the three-digit proposal identification number is required for the proposal form.

Scientific Category – Each proposal must identify one of nine primary research areas as listed below that is used to guide assignment of the proposal to the appropriate scientific review panel. These nine research areas (and some examples) are:

- **Planetary and protoplanetary systems** (planets, satellites, comets, circumstellar debris and disks, extrasolar planets)
- **Cool stars** (single and noninteracting binary systems)
- **Hot stars** (O, B, and Wolf-Rayet stars, white dwarfs, central stars of planetary nebulae, including hot stars in the Magellanic Clouds)
- **Interacting binary systems** (RS CVn systems, cataclysmic variables, symbiotic stars, mass-transfer binaries, novae)
- **Stellar ejecta and gaseous nebulae** (circumstellar material, H II regions, planetary nebulae, supernova remnants, supernovae)
- **Interstellar medium and galactic structure** (interstellar gas and dust, diffuse Galactic emission, Galactic halo, gas and dust in the Magellanic Clouds)
- **Galaxies and extragalactic stellar populations** (excluding the Magellanic Clouds)
- **Active Galactic Nuclei (AGN) and quasars**
- **QSO absorption lines and the intergalactic medium**

Proposal Sections – The proposal must contain the following Sections and be addressed in the order indicated for each proposed observing program. The page length limits are indicated.

1. **Scientific Justification (3 pages, except that proposals requesting 150 ksec or more may use up to 5 pages)** – Fully describe the scientific objectives of the proposed investigation, clearly stating its goals, its significance to astronomy, and why FUSE data are essential to the investigation. The page limit includes all text, figures, tables, and references for this Section.
2. **Feasibility and Safety (2 pages)** – The proposed program must justify the need for the requested exposure time for each target, noting the required signal-to-noise ratio (S/N) and spectral resolution, expected flux, channel requirements, and any other information relevant to the observation (e.g., wavelength region of interest, spectral flux distribution, emission line intensities). This Section forms the basis for technical assessment of the feasibility of the proposed observations. Describe the basis for and accuracy of the flux estimates, including any assumptions made or extrapolations into the FUSE spectral range from other wavelengths.

Description of Observations (1 page) – Describe the observations. All special requirements (e.g., usage of MDRS or HIRS apertures, Target of Opportunity, monitoring program, specific aperture orientation) must be summarized and justified. These requirements encompass any information affecting the scheduling of the target, such as pointing constraints (e.g., observations at specific times), scheduling constraints (e.g., coordinated observations, phase coverage, contiguous observations, etc.), Targets of Opportunity, and basic moving target data. However, actual ephemeris data for Solar System targets are not required for this phase of the proposal process.

Additional Information (1 page) – This Section may be used to provide any relevant information concerning data analysis plans, modeling capabilities, plans for supporting observations to be conducted using other telescopes, etc.

3. **Previous FUSE Observing Programs (1 page)** – Summarize the status, results, and publications arising from FUSE observing time allocated to the PI in previous FUSE GI observing cycles. The presentation of this information for Co-I's is optional.
4. **Principal Investigator and Co-Investigator Biographical and Publication Data (1 page)**
An abbreviated biographical sketch for the PI should be provided and include a list of the most recent refereed publications relevant to the scientific proposal. Additional biographical or publication data may be provided for any of the Co-I's.
5. **Proposed Target List** – Each proposal must include a table of the proposed targets for observation that includes all the requested target and exposure information and parameters described in the instructions for the proposal template. Proposers are strongly encouraged to use the LaTeX proposal form to prepare this formatted table of targets and exposure times. In all cases, these data must also be submitted electronically using this template. No LaTeX formatting is permitted in the target data entries.

C.3 Obtaining the Phase 1 Proposal Form and Instructions

The FUSE LaTeX proposal form and style file may be retrieved automatically via E-mail by sending a message to fuseprop@pha.jhu.edu with the word "help" as the subject of the message. The necessary files will automatically be sent by E-mail. These files, plus the instructions for preparing the proposal form, are also available electronically from the FUSE GI Program Web site <http://fusegi.pha.jhu.edu>.

C.4 Notices of Intent to Propose

In order to expedite the proposal review process and the timely selection of scientific peer review panels, investigators intending to submit proposals for participation in this program should submit a Notice of Intent (NOI) to propose by the deadline to the Web address given in the NRA Summary of Solicitation. This NOI Web site will request the tentative title of the investigation, name and affiliation of the PI and any Co-I's, and a brief summary of the objectives of the proposed investigation.

C.5 Proposal Submission

A complete proposal submission consists of the following three steps.

1. Provide basic summary information through the NASA Peer Review Services Web site (see Letter of Solicitation) and print the *Cover Page/Proposal Summary*. Note that the proposal number in the upper left-hand corner of the *Cover Page* must be inserted in the LaTeX proposal form in the appropriate keyword.
2. Send 12 printed copies of the proposal to the address given in the Summary of Solicitation. The PI must sign the printed *Cover Page/Proposal Summary* (see Section C.2.2) and attach it as the front of the proposal. Copies of the *Cover Page/Proposal Summary* must also be attached to the other 11 copies of the proposal that are submitted (i.e., one original and 11 copies must be submitted).
3. E-mail the LaTeX proposal form to fuseprop@pha.jhu.edu. An acknowledgment of receipt will be sent to the proposal submitter by return E-mail.

All printed and electronic proposal materials must arrive at the above address by the closing date given in the Summary of Solicitation to this NRA in order to be included in the proposal review for this cycle of the FUSE Guest Investigator program.

C.6 Evaluation and Selection Process

Proposals will be evaluated in a competitive peer review conducted by NASA Headquarters using review panels organized by research area (see Section C.2.3 above). The panel membership will include scientists from the U.S., Canada, and France. Upon completion of the review by the individual panels, a final cross-discipline panel review chaired by a NASA HQ representative will synthesize the results of the individual panels. Based on these results, the FUSE Program Scientist will then develop a recommendation for the total program to be submitted to the Selection Official. The final proposal selection will be made by the Director, Astronomy and Physics Division, Office of Space Science.

The following factors, listed in descending order of importance, will be used in evaluating proposals for their scientific merit and technical feasibility for the FUSE Guest Investigator Program.

1. The overall scientific merit of the proposed investigation;
2. The suitability and feasibility of using the FUSE observatory for the proposed investigation;
3. The feasibility of accomplishing the objectives of the investigation;
4. The feasibility of the data analysis techniques;
5. The competence and relevant experience of the Principal Investigator and any collaborators to carry the investigation to a successful conclusion, including timely publication of the research in peer reviewed journals.

The scientific review panels will be given an assessment of the technical feasibility of each proposal as determined by the FUSE Project. After acceptance of an observing program by NASA, successful proposers must prepare detailed observing plans for submission to JHU,

which are required for scheduling purposes. These plans, referred to as "Phase 2" plans, will again be assessed for feasibility. Should there be any question regarding the safety or feasibility of individual observations, the FUSE PI, in consultation with the FUSE Project Scientist, will make the final decision as to whether or not to attempt or postpone a particular observation, based on the latest information available regarding the satellite's on-orbit performance.

C.7 Other Conditions

NASA reserves the right to offer to select only a portion of a proposer's investigation, in which case the investigator will be given the opportunity to accept or decline such partial selection.

C.8 Funding for U.S. Investigators

Limited funds for awards under this NRA are expected to be available to investigators at U.S. institutions subject to the annual NASA budget cycle. Successful proposers at U.S. institutions, including U.S. Co-Investigators on successful non-U.S. proposals, will be eligible for funding. However, budgets should not be submitted with research proposals submitted in response to this NRA. Instead, the selected investigators will receive a funding guideline from NASA based on the scope of the approved observing program and the available budget for the FUSE Cycle 4 GI program. A budget summary and narrative description on how these funds will be spent will need to be submitted after the receipt of the guideline. An institutional signature will be required when a budget is submitted.

Copies of the three *Certifications* currently required by U.S. Code (Note: these individual *Certifications* are included for reference only and should not be signed and returned; language is now included on the proposal *Cover Page* that confirms that these certification requirements are met once the printed copy of the *Cover Page* is signed by the Authorizing Institutional Representative and submitted with the proposal).

C.9 Education and Public Outreach

The policy of NASA's Office of Space Science (OSS) continues to be to encourage strongly the participation by the space science community in education and public outreach activities with the goal of enhancing the Nation's formal education system and contributing to the broad public understanding of science, mathematics, and technology. A significant national program in space science education and outreach is now underway, and OSS's demonstrated contributions to education and outreach have now become an important part of the broader justification for the public support of space science (for further details open "*Education and Public Outreach*" on the OSS homepage at <http://spacescience.nasa.gov>). Education has also now become one of the core missions of NASA.

The two key documents that establish the basic policies and guidance for all OSS E/PO activities are a strategic plan, entitled *Partners in Education: A Strategy for Integrating Education and*

Public Outreach Into NASA's Space Science Programs (March 1995), and an implementation plan, entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (October 1996). Both of these documents may be obtained by selecting "Education and Public Outreach" from the OSS homepage at <http://spacescience.nasa.gov>, or by contacting Dr. Jeffrey Rosendhal, Office of Space Science, Code S, NASA Headquarters, Washington, DC 20546-0001.

Proposers awarded observing time under this NRA will be given an opportunity to submit a supplemental E/PO element to their research proposal in conjunction with the budget phase of the proposal process. Complete information about and instructions for preparing and submitting E/PO proposals will be supplied to successful US proposers following the selection of scientific proposals.

For important background information in developing an E/PO proposal, OSS has developed a document entitled *Explanatory Guide to the NASA Office of Space Science Education and Public Outreach Evaluation Criteria* as a resource for proposers. This guide may be accessed via <http://spacescience.nasa.gov/education/scientists/index.htm> ; navigation through this *Explanatory Guide* at its Web site is facilitated by internal active links. This Guide is not an extension of the E/PO requirements or criteria but is meant to provide an easy-to-follow introduction to this program using a series of Frequently Asked Questions (FAQ), along with a detailed discussion of the E/PO review criteria. All proposers who are considering the submission of an E/PO proposal but who are not familiar with the specific OSS standards for E/PO activities are urged to review this *Explanatory Guide*.

APPENDIX D

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160-19211). Copies of the regulation may be obtained by contacting the U.S. Department of Education, Grants and Contracts Service, 400 Maryland Ave S.W. (Room 3633 GSA Regional Office Building No 3), Washington DC. 20202-4725, telephone (202) 732-2505.

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Certification Regarding Lobbying

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000 for each such failure.

**Assurance of Compliance with the National Aeronautics and Space Administration
Regulations Pursuant to Nondiscrimination in Federally Assisted Programs**

The _____
(Institution or organization on whose behalf this assurance is signed, hereinafter called
"Applicant.")

HEREBY AGREES THAT it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1972 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and HEREBY GIVES ASSURANCE THAT it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which it retains ownership or possession of the property. In all other cases, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

THIS ASSURANCE is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contract, property, discounts or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognizes and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.